



Engineers are growing lettuce in JSC's new closed-loop life support test-bed. Story on Page 3.



The new gymnasium at JSC's Gilruth Center is going up quickly. Story on Page 4.

Space News Roundup

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Flawless dress rehearsal primes *Atlantis*

By James Hartsfield

Atlantis, fresh from a flawless countdown dress rehearsal, now enters the final stages of launch preparation for STS-37 with managers to meet Tuesday and Wednesday to set an official launch date.

Atlantis' launch on STS-37 has been targeted for the first week of April, possibly as early as April 5. The STS-37 crew—Commander Steve Nagel, Pilot Ken Cameron, and mission specialists Linda Godwin, Jerry Ross and Jay Apt—spent Tuesday and Wednesday at KSC participating in emergency launch pad escape training and the countdown rehearsal. The Gamma Ray Observatory (GRO), to be deployed

into a 243 nautical mile orbit on STS-37, was installed in *Atlantis*' payload bay Sunday.

Scheduled work on *Atlantis* now includes fueling of the spacecraft's orbital propulsion systems and testing of the connections between GRO and *Atlantis*.

Meanwhile, *Discovery*, removed from the launch pad early this month for repairs, is now in the processing hangar with those repairs nearing completion. *Discovery* is scheduled to be taken back to the Vehicle Assembly Bldg. early next week to be recon-

nected with the STS-39 solid rockets and external fuel tank. New housings and closing mechanisms, modified to strengthen areas

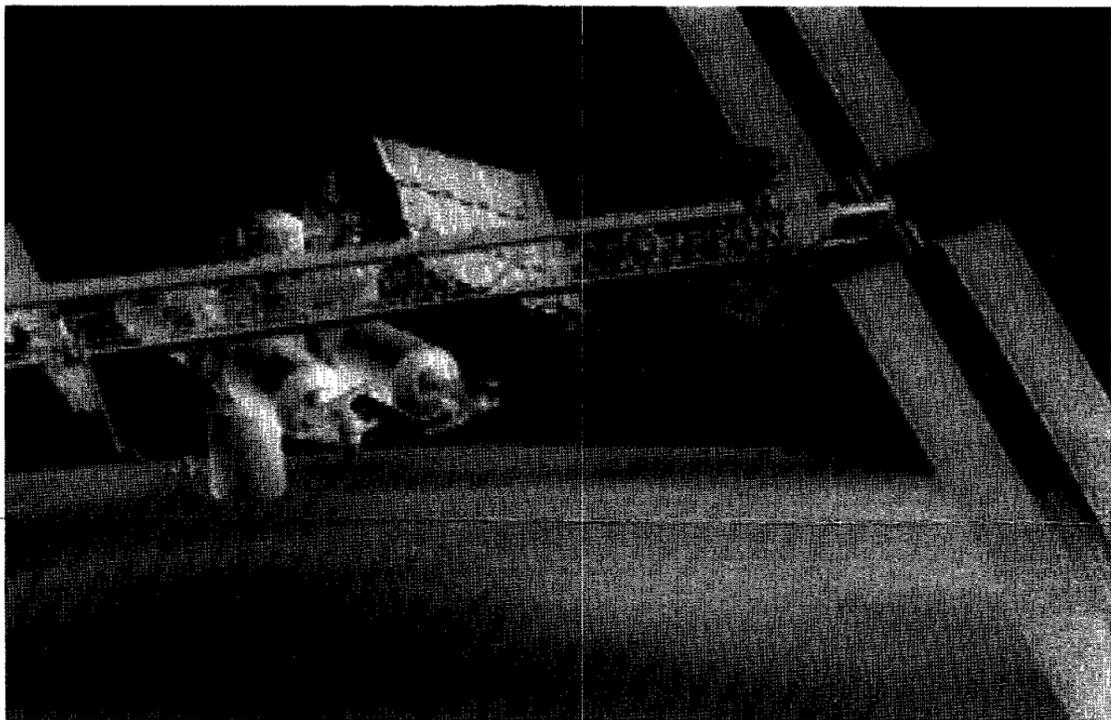
found cracked while *Discovery* was at the pad, have been installed on *Discovery*'s two fuel line doors, located on the underside of the craft. Thursday, technicians were opening and closing the

fuel line doors in final tests of the new hardware. The quick repair work keeps *Discovery* in gear for a possible late April launch on STS-39, the first unclassified Department of

Defense-dedicated shuttle mission.

Columbia, occupying the the other bay in KSC's processing hangar, had its three main engines installed this week. The Space Life Sciences-1 spacelab module will be placed in the cargo bay during the weekend.

The solid rocket boosters planned for *Columbia*'s flight on STS-40 had to be dethatched in the VAB this week when technicians found abnormal forces on the SRB hold down posts. The solids will begin being restacked on Saturday, and the added work from the momentary backtracking is not expected to impact a late May launch of STS-40.



NASA Computer Animation Still

The restructured Space Station *Freedom*, pictured in this still from a computer-animated assembly sequence video, will house up to four crew members in habitation modules that are 27 feet long and 14.5 feet in diameter, about 40 percent shorter than the previous design. The permanent manned configuration will have three sets of solar arrays capable of generating 65kw of power.

Space station restructuring plan complete

NASA Thursday delivered the "restructuring" report to the Congress, outlining an extensive redesign of Space Station *Freedom*. The new design is cheaper, smaller, easier to assemble in orbit and will require fewer shuttle flights to build.

Major new features of the redesigned space station—shorter U.S. laboratory and habitat modules that can be outfitted and verified on the ground and a pre-integrated truss that can be assembled and tested intact on the ground—will significantly reduce intravehicular activity and on-orbit extravehicular activity.

"This new design for Space Station *Freedom* accomplishes every major goal we set for ourselves when we kicked off this effort last November," said William B. Lenoir, associate administrator for space flight. "We took the directions from Congress and the Augustine Commission recommendations to heart, and the program we are announcing today addresses each and every one of their requirements."

"We've cut costs, simplified the design and reduced the complexity of the project. At the same time, *Freedom* will be a quality facility, providing a research laboratory unsurpassed in the world for life sciences and microgravity research, and a stepping stone into the future, enabling NASA to conduct the research and planning necessary for human exploration of the solar system. And, we have maintained our international commitments," he continued.

A 1991 fiscal year budget shortfall of more than \$550 million, along with congressional directions to significantly reduce out-year spending, prompted NASA to begin the restructuring of *Freedom*. Congress told NASA to expect no more than 8 to 10 percent growth over the next five years, with peak spending for *Freedom* not to exceed \$2.5-\$2.6 billion. The budgetary ground rules, including the cut for fiscal 1991, represent a \$5.7 billion shortfall from what NASA had planned to spend.

NASA began the review in November 1990 with instructions to the *Freedom* project team to: develop a phased approach with quasi-independent phases; protect life and materials science; maintain international agreements and capability; limit assembly flights to no more than four annually; and achieve first element launch, man-tended capability and permanently manned capability as early as possible.

The restructured program calls for the first element launch of the space station to be made between January and March 1996, and man-tended capability to be achieved by April or June 1997.

In the man-tended phase, astronauts brought up to *Freedom* by the shuttle will be able to work inside the U.S. laboratory for periods of two weeks. They will return to Earth with the shuttle. At this stage, one set of *Freedom*'s solar arrays will

Please see **FREEDOM**, Page 4

NASA adjusts shuttle manifest

NASA managers Thursday announced adjustments to the Mixed Fleet Manifest that compensate for the postponement of STS-39 mission because of cracks in *Discovery*'s external tank door drive mechanism housing.

The flights now projected for calendar year 1991 begin with *Atlantis* and the Gamma Ray Observatory flying in April. Following repairs to the door drive mechanism housing, *Discovery* will fly the STS-39 mission in May. The projected date for the STS-40 Space Life Sciences mission

aboard *Columbia* remains in May. *Columbia* will be taken off line for structural inspections and modifications for Extended Duration Orbiter capability following STS-40.

The Tracking Data Relay Satellite mission originally scheduled to fly on *Discovery* in July is now on *Atlantis* in August. The Defense Support Program mission remains on *Atlantis* but will move from August to December. These two adjustments preserve the agency's capability to fly *Discovery* with the Upper Atmosphere Research Satellite payload during its

required science window in October.

The International Microgravity Laboratory mission, planned for December 1991, will become the first flight in calendar year 1992. The mixed cargo flight of the Tethered Satellite System and the European Space Agency's European Retrievable Carrier originally scheduled for February on *Discovery* will move to August 1992 on *Atlantis*.

Flights in mid-1992 remain as previously manifested. Adjustments to the manifest beyond September 1992 are still being examined.

Sweet dreams of human expansion

Lunar and Planetary Science Conference takes sweeping look

By Kari Fluegel

Visions of Venus and dreams of Mars filled the halls of the Gilruth Center this past week as around 770 scientists and researchers attended the 22nd annual Lunar and Planetary Science Conference.

The newest data from the Magellan probe currently mapping Venus caused much discussion at the conference, believed to be the largest in recent years.

"People have been amazed at the quality of the data and the amount of the data," said Dr. Steve Saunders, Magellan project scientist from NASA's Jet Propulsion Laboratory.

Saunders said information from Magellan also probably will be featured in future conferences.

"It'll just grow as we get more of a complete picture of Venus," he said. "We're really just beginning."

Saunders, who has attended several LPSCs, also said the atmosphere surrounding this year's conference "feels

larger." He attributed the excitement to the enthusiasm about the information relayed during the conference and to the "feeling that the planetary program is moving again."

Another one of the highlights of the week-long event was a panel discussion about "Science Exploration and the New NASA," with JSC Director Aaron Cohen; Martin Marietta Chief Scientist Noel Hinners; JPL Director Edward C. Stone; and Assistant Administrator for the Office of Space Science and Applications Lennard Fisk.

Cohen said manned and unmanned exploration of the solar system must go hand in hand, and the Space Exploration Initiative establishes a long-term goal for the space program.

"It's an opportunity that is going to take people like you to be a reality," Cohen said. "It's going to take technology development. We're going to do it for scientific discoveries. We're going to do it for education. We're

Please see **LUNAR**, Page 4



JSC Photo by Jack Jacob

A chill chef shows off his "University of Mars" sweatshirt at a cookoff held in concert with the 22nd annual Lunar and Planetary Science Conference this week at the Gilruth Center.

JSC

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Gift Store from 10 a.m. to 2 p.m. weekdays.

General Cinema (valid for one year): \$4 each.
AMC Theater (valid until May 1992): \$3.75 each.
Loews Theater (valid for 1 year-can be used two weeks after movie premieres): \$4 each.

Bluebonnet Trail Trip (April 6 or 7, one trip includes tours of Independence and a historic church, the Rose Carousel, Miniature Horse Ranch, Rose Emporium and lunch; the other includes the Bluebonnet Festival, miniature horse race, the antique carousel and lunch): \$18.

Deep Sea Fishing Trip (7:30 a.m.-7:30 p.m. April 13, includes bait, tackle and crew to help during trip): \$45 to fish; \$20 to ride.

NASA Night at Astroworld (6 p.m. April 5, park closed to public): \$8 for first 5,000; \$10 for next 5,000.

Rockets vs. Utah Jazz (7:30 p.m. April 6, Summit): \$5.50.
Walt Disney on Ice (noon March 30-lower prom, Summit): \$8.

JSC

Gilruth Center News

EAA badges—Dependents and spouses may apply for a photo I.D. 6:30-9 p.m. Monday-Friday. Cost is \$5.

Defensive driving—Course is offered from 8 a.m.-5 p.m., May 18, June 15 and July 13. Cost is \$15.

Aerobic dance—Eight-week session meets 5:15-6:15 p.m. Tuesday and Thursday nights. Cost is \$24.

Exercise class—Class meets 5:15-6:15 p.m. Monday and Wednesday nights. Cost is \$24.

Weight safety—Required course for employees wishing to use the Gilruth weight room. The next class will be from 8-9:30 p.m. March 28, April 10 and April 25. Cost is \$4.

Country and western dance—Beginner only class meets 7-8:30 p.m. Friday nights for six weeks beginning April 5. Beginner or intermediate class meets Mondays from 7-8:30 or 8:30-10 p.m., respectively, for six weeks beginning April 22. Cost is \$20 per couple.

Fiction workshop—Classroom sessions meet for five weeks from 6:30-8 p.m. Wednesdays beginning April 3. After class readings will be from 8-10 p.m. Cost is \$80.

Aikido—Martial arts class meets from 6:30-7:30 p.m. Tuesdays for six weeks beginning April 2. Cost is \$30.

Ballroom dance—Ballroom dancing instruction will be offered in eight-week session beginning May 2. Cost is \$60 per couple.

Scuba—Four-week course meets from 6:30-9:30 p.m. Thursdays. Cost is \$50 plus additional fees. Free introductory session meets 6:30 p.m. March 28, Gilruth Rm. 222.

Tennis—Beginning tennis class meets Mondays for six weeks beginning March 25. Cost is \$32.

Basketball sign-ups—Basketball league sign-ups will be March 27-28 at the Gilruth.

Volleyball sign-ups—Volleyball league registration will be March 26 at the Gilruth.

JSC

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Dates & Data

Today

March meeting—The Houston Space Society will meet at 7:30 p.m. March 22 at the Embassy Room of the University Center, University of Houston Central Campus. Dr. Clark Chapman will speak about asteroids.

Cafeteria menu—Special: tuna and noodle casserole. Entrees: liver and onions, deviled crabs, roast beef with dressing. Soup: seafood gumbo. Vegetables: whipped potatoes, peas, cauliflower.

Saturday

Messiah sing—The Bay Area Chorus will start the 1991 season with its annual Messiah Sing at 7:30 p.m. March 23 at Webster Presbyterian Church. Music will be furnished or bring your own. Cost is \$5. Call 684-6030 for more information.

Monday

Lockheed NMA meets—The Lockheed National Management Association will present a brown bag luncheon at 11:40 a.m. March 25 in the Lockheed Plaza 4, Rm. 44F. "The Correlation of Economic Freedom and Living Conditions," will be the topic. For more information contact Charles Campbell at 333-6107.

Cafeteria menu—Special: breaded cutlet. Entrees: beef chop suey, Polish sausage with potato salad. Soup: French onion. Vegetables: okra and tomatoes, green peas.

Tuesday

BAPCO meets—The Bay Area PC Organization will meet at 7:30 p.m. March 26 at the League City Bank & Trust. For more information, call Earl Rubenstein, x34807, or Tom Kelly, 996-5019.

Picnic committee—The JSC Picnic Committee will meet at 5 p.m. March 26 at the Flamingo Cafe upper deck. For more information contact Melody Nation 33152.

JSC music festival—An open-mike Spring Music Festival jam-session has been slated for 4:30 p.m. March 26 at the Gilruth pavilion. All JSC employees are invited. The Southwind Band will host. For more information contact Paul Torrance or Ernie Smith, x31883.

Cafeteria menu—Special: fried chicken. Entrees: Salisbury steak, shrimp Creole. Soup: split pea. Vegetables: mixed vegetables, beets, whipped potatoes.

Wednesday

Astronomy seminar—The JSC Astronomy Seminar will meet at noon March 27 in Bldg. 31, Rm. 129. Call Al Jackson, 333-7679, for more information.

Cafeteria menu—Special: stuffed bell pepper. Entrees: fried catfish with hush puppies, braised beef rib, BBQ plate, wieners and beans, shrimp salad. Soup: seafood gumbo. Vegetables: corn O'Brian, rice, Italian green beans.

Thursday

ARC meets—The JSC Amateur Radio Club will meet at noon March 28 in Bldg. 16, Rm. 253. Carole Perry, 1990 New York Teacher of the Year, will speak. For more information, call Dale Martin at x37740.

NASACOM meets—NASACOM will meet at 7:30 p.m. March 28 at the Clear Lake Park Bldg. For more information contact Glenda at x31764.

BANN meets—The Bay Area NAFE Network will have its first night program of the year at 6 p.m. March

28 at the Shore Harbour Country Club in League City. Cherry Williams will conduct a showing of spring fashions from the Cherry Tree. For more information contact Mindy Cohen, x32600.

Cafeteria menu—Special: barbecue smoked link. Entrees: beef Stroganoff, turkey and dressing. Soup: chicken noodle. Vegetables: Lima beans, buttered squash, Spanish rice.

March 29

Cafeteria menu—Special: meat sauce and spaghetti. Entrees: baked scrod, liver and onions, fried shrimp. Soup: seafood gumbo. Vegetables: green beans, buttered broccoli, whipped potatoes.

April 1

Lockheed NMA meets—The Lockheed National Management Association will present a brown bag luncheon at 11:40 a.m. April 1 in the Lockheed Plaza 4, Rm. 44F. "False Economic Ideas and Their Origins," will be the topic. For more information contact Charles Campbell at 333-6107.

April 15

STS-1 anniversary—JSC will mark the 10th anniversary of the first space shuttle mission with a crew return celebration from 4:30-8:30 p.m. at the Gilruth Center. Tickets are \$3 and go on sale March 21 at the Exchange Store. Call Ginger Gibson at x30596 or Cyndi Draughton at x30494 for more information.

April 21

Scholarship and spring concert—The Bay Area Chorus will present a spring concert at 3 p.m. April 21 at United Methodist Church of Pasadena. Tickets are available by calling 684-6030.

Swap Shop

Property

Rent/Lease: Clear Lake marina condo, three level, all appli, FPL, wet bar, 2-2-2, \$950/mo. 474-4922.

Sale: Sycamore Valley/Ellington Field, 3-2-2, FPL, formal DR, fenced, new paint, no pets, \$695/mo. 482-6609.

Sale: Oakbrook West 2-story, ex cond, 4 BR, formals, family rm, new carpets/floors, \$145.9K nego. 480-4380.

Sale: LC Meadowland, new sect, 3-2-2, ex cond, pool, deck, patio cover, 10% assum, \$75.8K. John Gillman, 280-7461 or 538-2072.

Sale: Lake Travis cond, Lago Vista, TX, 2-2, furn, new carpet, ex cond. Jo Jaschke, 326-3177.

Sale: 4 cemetery lots at Forest Park East, \$2000. Bob, 337-2261.

Sale: Clear Lake 2-story condo, 1-1-5-cp, patio, balcony, all appli, FPL, \$38K assum. 486-0508.

Lease: One BR condo, refig, W/D, FPL, pool, lg walk-in closet, \$390 plus \$200 dep. 554-2912.

Lease: Oakbrook West, 4-2-5-2, formals, family rm, FPL, fenced, no pets, \$975/mo. 488-5210.

Sale: LC Brittany Bay, 4-2-5-2, \$102.5K assum 8%, \$62K bal. 332-0047.

Rent/Sale: Friendswood Heritage Park, 4-2-2, fenced, new paint, carpet, \$700/mo plus dep, \$68.5K. David, 282-4519 or 486-5732.

Rent: Friendswood area, enclosed RV storage stall, 40' deep, lights/pwr, reasonable rate. 482-9396.

Sale: Bay Glen, 3-2-2, 2050 sq ft, great rm, formal DR, study, assum, \$122.5K. 480-0527.

Lease: Pipers Meadow, 3-2-2, study, lg kitchen, formal DR, FPL, patio, avail April 1, \$825. Jon, 282-5165 or 661-3430.

Lease: CLC Oakbrook, 4-2-5-2 attached 1 story, fenced, prefer no pets/child/smoker, \$1000/mo plus dep, 488-3171.

Sale/Lease: LC Countryside South, 3-2-2, formal DR, lg kitchen, util rm, FPL, lg backyard, CA/H, new paint, ex cond, no pets, \$79,948 or \$875/mo. Tracey, 748-2252.

Sale: Middlebrook, 3-2-2, cul-de-sac, new paint, carpet, ceramic tile, new A/C in '89, \$89K. 538-1051.

Sale: Pipers Meadow, 3-2-5-2, formals, FPL, loft, wet bar, fans, deck, new paint, \$90K. Dennis, x34405 or 480-5076.

Cars & Trucks

'59 Studebaker Skyhawk, all original, eng needs repair, \$2000 OBO. 691-6992.

'84 Ford 3/4 PU, V8, auto, super cab, XLT pkg, capt chairs, rear bench, Durairner, grill guard, blk and gray. (409) 986-6381.

'84 Volvo GL, sun roof, auto, ex cond, 86K mi, \$4990. David, 554-5514 or 282-3827.

'84 Ford van, XLT club wagon, ex cond, new tires, loaded, 75K mi, \$6500. 482-1582.

'87 Chev Cavalier, white, 4 dr, auto, A/C, 38K mi, ex cond, war, \$4250 OBO. Dave, x39579 or 482-6187.

'82 Ford Anaheim custom van, loaded, 4 capt chairs, sofa/bed, 2 A/C, 2 tanks, CB, BO. 488-3191.

'80 Chevy Citation, 42K mi, good cond, 4 dr, \$1500. 334-4604.

'89 Subaru, 26K mi, Silverado pkg, dual air, loaded, Chevy radar detector, draw tie removable hitch, two tone blue, tint windows, 40 gal tank, assum bal \$15,758. Dale, x39441, 764-2571.

'87 Olds Cutlassiera, 4 cyl, 4 dr, A/C, PS, PB, auto, AM/FM, 65K mi, \$5750 OBO. Richard, x33184 or 482-8230.

'84 Camaro, V6, auto, A/C, tu-tone blue, 51K mi, ex cond, \$3400. x37108 or 486-8463.

'86 Chevy PU, eng work needed, \$475. x31883.

'82 Pontiac Bonneville wagon, ex cond, all pwr, cruise, tilt, AM/FM/cass, A/C, V8, \$1600 OBO. Glenn, x38067 or 484-4709.

'85 Ford Tempo GL, 5-sp, A/C, 4 dr, cruise, tilt, good cond, \$2600 OBO. 332-8771.

'71 5th wheel travel trlr, ex cond, self-contained, \$3500 OBO. 475-3663 or 476-9092.

'84 Camaro, pwr, A/C, IROC accents, 65K mi, silver gray, ex cond, \$3650. x38851 or 944-7042.

'88 Ford F150 supercab, 6 cyl, 5 spd, 27K mi, ex cond. 944-5624.

'89 Ford Probe GT Turbo, 5 spd, 100K mi war, ex cond, D40M2 Dunlops, \$11,500. Dan, 280-2780 or 457-2850.

'77 Pontiac Trans Am, new paint, A/C, pwr windows, steering, brakes, good cond, \$1995. 482-1633.

'59 Ford Ranchero, all orig, needs restoring, \$500 OBO. '24 Dodge sedan, all orig and drivable, good cond, \$10K

OBO. (409) 935-3752.

'80 VW Rabbit diesel, new brakes, timing belt, recon starter, new batt, good tires, runs but needs work, \$350 OBO. x30055 or 332-7905.

'87 Nissan 300ZX, T-tops, 5 spd, low mi, white/red int, ex cond. 771-0955.

'89 T-Bird, white, 2 dr, 4 spd auto, new tires, loaded, V6, 40K mi. 333-6320 or 996-0996.

'75 Triumph Spitfire, restored, eng rebuilt, hard/soft tops. \$4500. 326-2378 or 946-4174.

'85 Toyota Celica GTS, blk, pwr windows and sunroof, gray leather int, new brakes, records, \$6000 OBO. 488-8781.

'88 Mercury Sable wagon LS, 47K mi, 100K mi war, loaded, \$9000 OBO. Terry, x36351 or 996-9164.

'89 Ford Econoline van, Tra-Tech Diamond ed, 36K mi, ex cond, \$12,800. (409) 925-4743.

'88 Ford Mustang, V6, 40K, loaded, new tires, 28K mi, \$8700. Tom, x39592 or 532-1518.

'88 Cutlass Supreme Intl, 2 dr, spl cpt, 2.8 multiport fuel inj, all pwr, 40K mi, \$8800 OBO. Kirk, 282-2911 or 332-5876.

'84 Porsche 928s, auto, alarm, sunroof, pwr windows, seats and mirrors, 57K, records, ex cond, \$5500. 485-7555.

'88 Jeep Wrangler, AM/FM stereo, pwr str/brk, 25K mi, \$7300. x31498.

'86 Buick Century Ltd, cruise, pwr locks, tint, ex cond, low mi, \$4950. x32746 or 488-7856.

'86 Buick Regal Ltd, all pwr, V8, 2 dr, ex cond, 70K mi, \$4800 OBO. 282-4041 or 337-2318.

'81 Ford F150 PU, \$2000 OBO. 470-2023.

'73 Datsun 240Z, new tires, runs good, \$1800. Gary Johnson, x34136 or 488-0353.

'80 Pontiac Phoenix, V6, A/C, 5 dr, ltrbk, auto, AM/FM stereo, good cond, \$1950. x30092 or 481-3637.

'87 Toyota Corolla, white, 4 dr, auto, A/C, ex cond, 81K mi, \$4300. 283-4258 or 480-9125.

'83 Monte Carlo, \$3500 OBO. '84 Mustang, \$4000 OBO. Gretchen, 283-0446 or 482-6744.

'87 Nissan Sentra, 2 dr, 5 spd, A/C, AM/FM/cass, tint, 75K mi, ex cond, \$3000. Steve, x35450 or 480-1658.

'88 Mazda 323 SE, 47K mi, A/C, AM/FM/cass, sunroof, new tires, records, \$4300. x31027 332-8743.

'77 Chevy Monte Carlo, 350 V8, 115K mi, A/C, AM/FM/cass, new tires, trans, \$1500 OBO. Mark, x37491 or 335-1494.

'87 Ford Tempo GL, black w/red int, 4 dr sedan, 75K mi, ex cond, \$4000. 538-1051.

Cycles

'80 Moto Guzzi 1000 SP, good cond, garaged, \$1600. Luis Llano, 282-5570 or 538-3458.

Two girl's bicycles, ex cond, for 6 and 9 yr old, good quality, \$50 ea. Bob, x33149 or 488-7036.

'84 Yamaha YZ 125, water cooled, used little, ex cond, tree gas container, \$695. 482-1633.

New Vetta C-100 Innovator speedometer, clock, odometer, max speed, stopwatch etc, \$30 OBO. Kelly, 282-2586.

'81 Honda 750 custom, windjammer, radio, sissy bar, low mi, good cond, \$650 OBO. Bruce, 485-0396.

'84 Kawasaki GPZ 750 motorcycle, 8K mi, clean, \$2000. Shannon, x32646 or 484-5412.

'81 Honda 650cc, new tires, new batt, windshield, back rest, good cond, \$850. Gene, x36424 or 474-4289.

CB 1000 frame w/works, front and rear wheels, asstd parts, \$150. Jeff, x32578 or 488-2543.

Man's Raleigh Technium 440 bike, 10 spd, quick release front wheel, ex cond, \$2500. Tom, 424-4053 or 286-0041.

'75 Honda 550cc, 4 cyl, runs good, good tires, 2 helmets, manual, \$425 OBO. x30686 or 480-3269.

Boats & Planes

Boat slip on Clear Lake w/roof and motorized hoist for pwr boats, \$125/mo. 474-4922.

12' fiberglass V-hull Jon boat, \$225; 5 hp OB, new prop and tuned, \$200. 339-1957.

16' bass boat, VIP, 85 hp Johnson, trolling motor, bait wells, galv trlr, needs work, \$750. Killingsworth, x38396 or 488-1689.

'79 Renegade 1540 ski boat, 140 hp Evinrude, SST prop, custom trlr, new seats, carpet, paint, jng sys, etc, 45 plus mph, \$2500 OBO. 333-6868 or 486-7846.

24' J24 sailboat, 3 complete sets of sails, incl spinnakers, trlr, new OB, kept in dry storage at Seabrook Shipyard, \$9500 OBO. Glen, 280-8644 or 282-3699.

'70 Coronado 25, new main sail w/cover, 2 jibs, depth sounder, compass, 7.5 hp OB w/controls, good cond, \$5500. John, x30217 or 484-0395.

'85 Executive Mooney aircraft, completely updated, 1-Four place, new upholstery, slope back windshield speed mod and paint, eng needs annual, install inst panel. Jo Saschke, 326-3177 or 484-9009 or Bill Hudson, 487-4705.

'17 Ouachita aluminum canoe, \$400. 474-4663.

'88 17' Bayliner, blue and white w/trlr, AM/FM, life jackets, less than 50 hrs on motor, 75 force, clean, \$5200. x33243 or 444-6737.

New Pantidesi racing shell skulls w/new padded carrying case, \$200. Samouco, x35053 or 482-0702.

25 hp Evinrude, elec start, new, \$1700. Jerry Craig, 283-5311 or 420-2936.

'72 30' Morgan sailboat, new diesel eng, \$15,500 OBO, will carry note w/ 1/3 down. Bill, 283-5384 or 326-1880.

'83 Renken 18' sailboat, roller furling jib, 4 hp aux, galv trlr, sleeps 4, good cond, \$4000. 339-3476.

Audiovisual & Computers

Sony video camera head, w case and some documentation, not a Camcorder, \$50; Teeco CGA 14" monitor, not working, swivel stand, \$10. Terry, x35026 or 554-6549.

PC-AT 286 computer, 1 MB RAM, 12 MB FD, paper-white Emerson monitor, mouse, SW, \$555. Wayne, 282-3261.

Marshall speaker cabinet, slant front, 4 100W Celestial speakers, \$400 OBO. 326-2790.

Brother HR-15XL daisy wheel printer, ex cond, \$50. x38039.

AT&T 6300 computer, 640K RAM, 30 MB hard card, 2 360K FD, game port, game card, 8087 coprocessor, color graphics monitor, \$700. Keith, x38024 or 554-4309.

640K IBM compatible, all orig books/boxes, 150 floppies, SW, 20 MB HD, 360K FD, Herc mono graphics 8087 cop, \$500; 200W pwr supply, \$40; ext 5.25 case, \$5; 3.5 to 5.25 adaptor, \$5; VGA board 512K 1024 x 768, \$75. Jeff, x32578 or 488-2543.

IBM 256/12 MHz clone, 40 MB HD, 1.44 and 1.2 floppies, EGA color, access, books, games, SW, \$1250. 481-4238 or 795-1034.

AT&T 6300 PC, 8 MHz, 20 MB HD, mouse, all ports, SW, ex cond, \$675 OBO. Jon, 661-3430.

IBM XT computer, 640K, 30 MB HD, 2 FD, color monitor, \$975, x30092 or 481-3637.

Musical Instruments

Tascam 4-track recorder, \$300. Jim, 333-7690 or 488-4820.

Spring Harvest

JSC biogenerative system produces first lettuce plants

By Pam Alloway

This spring is not only planting time. It's also harvest time in the Crew and Thermal Systems Division, and the crop harvested will give scientists and engineers vital information that could impact humans' self-sufficiency on the Moon and Mars.

CTSD scientists and engineers recently harvested their first crop of Grand Rapids Lettuce grown in a specially outfitted chamber housed in Bldg. 7A. They initiated the 30-day test Jan. 25, marking an important milestone in studies on regenerative life support systems involving plants at JSC.

A complete regenerative life support system involves the recycling of air, water and waste and the production of food, all critical elements to NASA's future long duration missions.

CTSD personnel designed the test to verify the new fully-automated RLSS test-bed plant growth chamber, its ability to operate at reduced atmospheric pressures that more closely duplicate lunar and Martian habitat environments, and whether it can grow crops from seed to harvest without human intervention.

Engineers and scientists have taken a multi-level approach to JSC's RLSS project. The project itself includes physicochemical life support research and development, a test chamber, plant growth research and life science requirements, all of which will contribute to an RLSS data base. Scientists and engineers will use the information gleaned to develop a flight experiment and a pilot RLSS test facility that, in turn, would lead to a human-rated RLSS test facility.

"The purpose of the regenerative life support system test-bed is to gather data necessary to provide information for similar systems on a lunar and Mars base," said Wil Ellis, CTSD chief. "The four unique aspects of this regenerative life support test-bed activity that JSC offers the agency are: a closed chamber, reduced pressure capability, integration of biological and physicochemical systems, and the ability to get direct engineering data to build a human-rated test facility."

Air revitalization, water/waste management and physical/chemical processes all play a part in the work being done in the physicochemical life support area.

An RLSS would give crews on a lunar or Mars outpost, or a two-year Mars transit flight more self-sufficiency and less dependency on resupplied expendables from Earth. The system would use plants and microbes in various bioregeneration processes to produce food and clean the outpost's air and water.

Ellis said it is likely a life support system for a lunar or Mars outpost will combine advanced bioregenerative systems and current shuttle-type

life support technologies. An initial outpost, not much larger than a spaceship, probably would use pumps, fans and filters similar to those found in the shuttle life support system. Later, the outpost's life support system could evolve into progressively more complex systems with physicochemical and biological components.

Regenerative life support work also is under way at Ames Research Center, Kennedy Space Center, and Marshall Space Flight Center.

Until last year, JSC's life support system work was divided between two directorates — Engineering and Space and Life Sciences. Managers decided to consolidate the work under one directorate and combined people working on RLSS technology into the CTSD's Life Support Systems Branch as part of the recent Engineering Directorate reorganization.

Those scientists and engineers are focusing research efforts on integrating an RLSS in preparation for flight hardware development.

Hand-in-hand with that effort is the need to identify areas where technology development is necessary to coordinate the integration and allow the systems to evolve together.

The effort began with the design and fabrication of a relatively small, inexpensive Plant Chamber Concept Proof Test Box. Scientists and engineers used the box to determine the specific requirements needed for the RLSS test-bed plant growth chamber.

Taking information from the test box, scientists and engineers designed, fabricated and tested a fully operational test-bed in less than a year.

The test crop in the new RLSS plant chamber grew in an array of 480 receptacles that used an industry-standard solid substrate medium irrigated with a standardized nutrient solution. The nutrients were added via an automated irrigation system. The chamber was designed to grow enough plants to provide food for one person, and air and drinking water for several people, Ellis said.

Initial tests will use lettuce and wheat because they both have rapid growing cycles and enable scientists and engineers to collect reams of data. Lettuce goes through its entire growth cycle in four weeks, and wheat in nine to 10 weeks.

"This experiment is unique because the compatibility of physicochemical processes with plants is being evaluated under closed-chamber



conditions," Ellis said. "JSC is trying to put together a bioregenerative support system as integrated as possible. We're getting very precise data in our program."

JSC originally used the RLSS plant chamber in developing and testing the initial shuttle life support system.

"We can control all environmental conditions essential to the growth of plants," said Dr. Don Henninger, RLSS chief scientist. "There are about 250 measurements fed from the test-bed to the data acquisition and control system. Data is acquired about every 10 seconds. Every hour we get a summary of all the conditions."

Outside the chamber are three large tanks in which oxygen produced by the plants is stored

for measurement and analysis. Nearby, two other tanks hold carbon dioxide which is injected into the chamber to support photosynthesis and crop growth.

Water produced from the plants also is collected, measured, and analyzed.

Samples of the chamber's atmosphere pass through a series of gas analyzers to measure and control the atmospheric gas composition.

"We're looking at how to maximize life support, for instance, through maximum food production," Ellis said.

Adjacent to the RLSS plant chamber is a control room that houses the computers that control the chamber's internal environment and meticulously record all the data pertaining to that chamber.

"This (the control room) runs automatically," Ellis said. "It's set up so if there's any problem the computer identifies it, takes corrective action, and then notifies key test personnel via a telephone message system."

Just as the scientists and engineers carefully laid out the plant growth receptacles in neatly organized rows and divided those rows into "zones" where test conditions could be adjusted, they have methodically laid out a plan to take the research and development program from test-bed status to an outpost support system.

Phase one, which occurred in 1990, was to convert the existing 10-foot chamber into a plant growth facility. Within the facility engineers designed solid support substrate (soil based) plant growth beds, an irrigation and nutrient feeding system, atmospheric conditioning for the chamber,

and atmosphere and water sampling. Scientists also initiated plant growth during this phase.

"This is one way JSC's efforts are different from either Ames' or KSC's work," Ellis said. "JSC's experiment is a completely closed environment facility and our vacuum chamber can run at reduced pressure. For instance, rather than 14.7 pounds per square inch or ambient pressure we can run it at 10.2 psi which is the potential reduced habitat pressure limit that would be used on a lunar or Mars base. . . . The system is considered closed because it is completely sealed from the external environment and we put all the necessary support equipment inside the sealed chamber."

In phase two of JSC's RLSS project, which experimenters currently are working on, scientists and engineers will add hydroponics to their growing regimen, Ellis said. Using a hydroponic system, plants will be grown in a continuous flowing nutrient solution rather than a solid substrate. Experimenters also plan to install a vacuum system for reduced chamber operation in the RLSS plant chamber.

Scientists opted not to concentrate on hydroponics exclusively because the lunar soil has some unique characteristics. Synthetic soils called zedlites can be manufactured from lunar materials.

"We need to get experience with both soil based and hydroponic systems to get good engineering data," Ellis said. "This will, in turn, allow us to optimize the best approach."

Phase three will encompass concentrated efforts on defining physiological processes and completing work on a 20-foot chamber that would support four people. The 20-foot chamber also will be in Bldg. 7A. Scientists and engineers will incorporate physicochemical air revitalization, including carbon dioxide production and removal, perform water recovery from humidity condensation, initiate plant waste processing, continue plant growth and begin an assessment of physicochemical and biological life support systems. This work is scheduled to occur in 1992 and 1993.

In phase four, workers will construct a human-rated RLSS test bed facility adjacent to Bldg. 241. Scientists and engineers are preparing to conduct research on waste water management in Bldg. 241 and that work will be used to support the RLSS plant chamber activities.

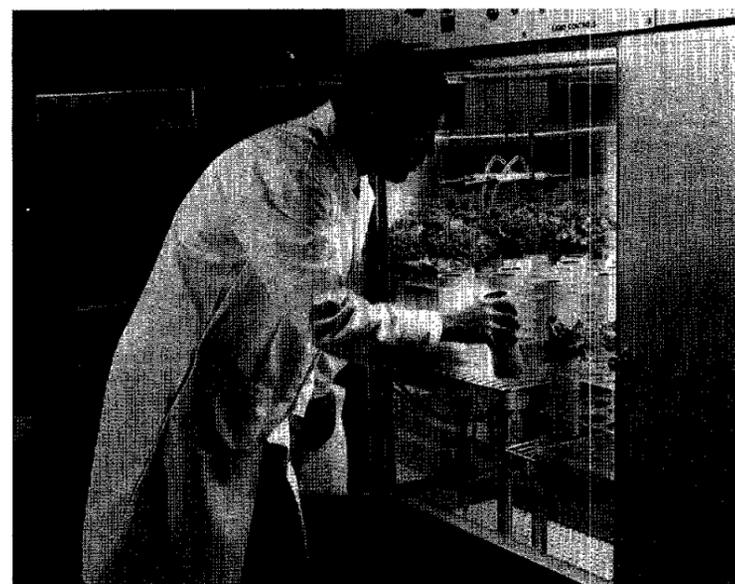
By fiscal year 1997, RLSS scientists and engineers hope to conduct human testing with the system.

But as work in phase two continues, the RLSS test-bed team is making improvements to the chamber now that the first crop has been harvested. A repeat plant growth test is planned for late next month, followed by a series of tests involving plant growth in simulated lunar soil.



JSC is trying to put together a bioregenerative support system as integrated as possible. We're getting very precise data in our program.

—Wil Ellis



Regenerative life support systems now being developed could be the predecessors of those systems that humans take to the Moon and Mars. Above: Dr. Don Henninger, RLSS chief scientist, top, and Dr. Dan Barta, plant physiologist, check on the conditions of their experimental lettuce crop in the RLSS plant growth chamber in Bldg. 7A. Left: Bob Spanarkel, a Lockheed plant physiologist, takes a look at one of the growth cylinders in the Bldg. 7B support laboratory near the test-bed plant growth chamber. Right: RLSS Project Engineer Terry Tri monitors the RLSS test-bed from the adjacent control room.

JSC Photos by Robert Markowitz

NASA ends Dynamics Explorer's fruitful career

The Dynamics Explorer (DE)-1 satellite, which acquired the first global images of the Earth's aurora, was officially retired by NASA on Feb. 28, 1991. Designed to operate for three years, DE-1 performed for nearly a decade in space.

Fred Gordon, the spacecraft operations manager at Goddard Space Flight Center, said the decision to stop gathering data from DE-1 was based on the cost versus the expected value

of the science gained. Also influencing the decision was the fact that the spacecraft has refused to accept commands at various times since Nov. 17, 1990.

According to Dr. Robert Hoffman, project scientist, the spacecraft's cameras, in a single view from high altitudes, could see an entire auroral zone, a ring of light encircling each polar region. These images, taken 12 minutes apart, have proven invaluable

in studies of "auroral substorms," when the aurora suddenly brightens and expands and when electric currents flowing between the magnetosphere and ionosphere greatly increase in intensity, Hoffman explained.

The Dynamics Explorers Program, which consisted of two spacecraft, was designed to study the coupling or interchange of energy, electric currents and mass between the upper atmosphere, ionosphere and the

magnetosphere. Hoffman said that the quality and quantity of data returned from the two spacecraft far exceeded the expectations before launch. Scientists associated with the program will continue to analyze for many years the large volume of scientific data accumulated.

The DE-1 spacecraft and its companion spacecraft, DE-2, were launched together Aug. 3, 1981, from Vandenberg Air Force Base, on a

Delta rocket and placed into polar elliptical orbits. DE-2 ceased operations Feb. 19, 1983 and re-entered the Earth's atmosphere the next day.

The DE-1 satellite is among the more successful Explorers. The first U.S. satellite was Explorer 1, launched in 1958, which discovered the Earth's trapped radiation, or the Van Allen belts. Since then, 71 other Explorers have been launched to conduct various scientific studies.

JSC runners on their marks for Intercenter Run

NASA civil servants and contractors from throughout the agency will be running for their home teams in the biannual Intercenter Run next month.

All 11 NASA centers and Headquarters will be competing against each other in 10K and two-mile runs. Scoring is calculated using the order in which a runner finishes and the percentage of participation at each center.

At JSC, runners time themselves for a two-mile run, 10,000 meter run or both. Each individual then reports to the Gilruth Center, Rm. 146, to enter his or her times. As times improve, the scoring sheet is updated for each runner.

Participants will receive a free Intercenter Run T-shirt. Only badged employees are allowed to participate.

The competition begins April 1 and extends through April 30. At the end of the month, the scoring sheets will be submitted. Results will be available a few months after that.

For more information, contact the Gilruth Center at x35789.

Deadline nears for scholarship requests

The deadline is nearing for applications for two scholarship programs that help dependents of JSC employees continue their educations.

March 29 is the last day to submit applications for both the JSC Exchange Scholarship Program and the NASA College Scholarship Fund Inc.

This year's Exchange Scholarship provides up to \$1,000 a year for four years for four students. Applications are available in Bldg. 45, Rm. 706 or by contacting Nicky Dinick at x33161.

The NASA College Scholarship will award three scholarships of \$1,500 a year, renewable for six years, in 1991. Applications are available in Bldg. 1, Rm. 840, or through Mary O'Connell at x39168.

Electronic printing training available

The Office Services Section in JSC's Management Services Division is offering workshops to acquaint center computer users with the Electronic Printing System.

The EPS, housed in the Printing Management Branch in Bldg. 227A, receives and prints flight documentation electronically using high-speed laser printers with a bitmap scanning system for photographs and graphics.

Users can transmit data via the Ethernet network from Xerox workstations or personal computers using the ASCII format. In the future, the system will be expanded to receive documents from workstations using TCP/IP or Novell protocols.

The workshops are designed to teach users to prepare documentation for transmission to the EPS. The training includes 12 hours of instruction over four days, conducted at the Hernandez Engineering training facility on Mercury Drive and in Bldg. 227A.

Civil service and contractor employees are eligible to apply for the free training, which will be scheduled as needed. For more information, contact Sharon Stafford at Hernandez, 480-0431, Doris Grosshauser at x34005, or Cheryl Hudgins at x36149.



GOING UP—Nick Gotting, left, and Steve Martinez, employees of subcontractor Parmley Electric install electrical conduit under the ceiling of the new gymnasium being added onto JSC's Gilruth Center. Century Builders Inc., the prime contractor, has completed about 50 percent of the project, said NASA/JSC Exchange Manager Teresa Sullivan. The new gym, complete with wooden floor, is scheduled to be ready for sports in May.

JSC Photo by Jack Jacob

Security cutting secret clearances

With classified Department of Defense shuttle missions having become a thing of the past, JSC's Security Division is hoping to eliminate about half of the center's "secret" clearances.

Bob Nooney, the security specialist coordinating the recertification of clearances, said 40 to 50 percent of the center's current secret clearances will be withdrawn if supervisors who submit justifications during this year's annual clearance survey follow the new guidelines.

"Maintaining secret clearances for personnel who do not have a continuing need for access to classified information is costly, time consuming and is not a good security practice," Nooney said.

STS-38 in November was the last DOD flight required to be flown in the secure operations mode, he said. Physical Control Zones are being discontinued, and by May all classified information will be removed from computer systems. Therefore, supervisors must remember that access to secure areas can no longer be used as the basis for secret clearance requests.

Security already has received about half the responses to its survey

and is returning many of the "secret" requests for reevaluation by supervisors under the new guidelines. Nooney said supervisors are being asked to evaluate each employee's needs and submit only those that can be justified. Justifiable reasons include routine (at least once a week) attendance of classified meetings or routine handling of classified materials. If a sudden need for additional clearances should arise, he said, most JSC employees can be granted interim clearances the same day.

The personnel access control system for areas such as the Mission Control Center, the Mission Evaluation Room and Software Production Facility will remain in use under the National Resource Protection Plan. Employees who work in those areas will still need to run their PCZ cards through the readers to gain access, Nooney said, but they will no longer be required to have secret clearances to obtaining those cards.

"Under the National Resource Protection Plan, people will still have to be investigated, but not to the level they did before," he said.

Anyone who has questions about the new policy should call Nooney at x34019.

Freedom restructuring plan limits assembly flights

(Continued from Page 1)

NASA began the review in November 1990 with instructions to the Freedom project team to: develop a phased approach with quasi-independent phases; protect life and materials science; maintain international agreements and capability; limit assembly flights to no more than four annually; and achieve first element launch, man-tended capability and permanently manned capability as early as possible.

The restructured program calls for first element launch between January and March 1996, and man-tended capability by April or June 1997.

In the man-tended phase, astronauts brought up to Freedom by the shuttle will be able to work inside the U.S. laboratory for two-week periods. They will return to Earth with the shuttle. One set of Freedom's solar arrays will generate about 22 kw of power with a minimum of 11 kw available to users. Six shuttle flights will be required to achieve the man-tended configuration.

Freedom will achieve a permanently

manned configuration in fiscal 2000. This configuration will consist of the U.S. laboratory and habitat, as well as the European and Japanese laboratories; the Canadian Mobile Servicing System; accommodations for a live-in crew of four; and three sets of solar arrays furnishing 65 kw of electrical power, with a minimum of 30 kw going to the users and the remainder to housekeeping chores.

A new requirement before permanently occupying the station will be the availability of an Assured Crew Return Vehicle to return crew members to Earth in an emergency. Seventeen shuttle flights will be needed to build the permanently manned configuration.

Provisions to expand the station have been retained. The follow-on phase will include another solar array to achieve 75 kw, provisions for 4 more crew members. This phase would use the new launch system if it is available.

The redesigned U.S. modules are 27 feet long and 14.5 feet in diameter, about 40 percent shorter than the

previous design. The smaller size allows the modules to be fully outfitted and tested on the ground. The U.S. lab module will hold 24 8-foot wide racks, 15 of which initially are devoted to scientific work. At permanently manned capability, 28 experiment racks will be available.

The redesigned truss segments will be built, preassembled and checked out on the ground. Formerly, the truss was to have been assembled, "stick by stick" like a massive erector set, by astronauts performing space walks, Lenoir said. NASA estimates the pre-integrated truss will cut assembly EVA by more than 50 percent.

While work on the Attached Payload Accommodations Equipment suitable for large external payloads has been stopped, utility ports for small external payloads will be placed along the truss. The overall width of the station has been reduced from 493 feet to 353 feet.

In addition to changes to the flight hardware, a number of changes to ground facilities are planned. The size

of planned facilities at JSC—the control center and crew training facilities—have been scaled back. The Space Station Processing Facility to be built at the Kennedy Space Center will not be fully outfitted, and payload facilities at Marshall Space Flight Center are being deferred.

Due to funding cutbacks and hardware changes in the program, some layoffs of prime and subcontractor personnel have already taken place, and more are expected.

In JSC's Work Package 2, prime contractor McDonnell Douglas has already reduced its work force by about 160, with hng for approximately half of that. Another 200 will be reduced from supporting development, with about 65 of that total coming from terminations.

Also called for is the transfer of the Flight Telerobotic Servicer to NASA's Office of Aeronautics, Exploration and Technology. This, together with the deferral of the APAE, has eliminated Goddard Space Flight Center's Work Package 3 from the Freedom program.

Lunar data just part of conference

(Continued from Page 1)

going to for potential resource utilization. And I eventually think commercial development will come into being."

The primary problem facing the space community is communication of the SEI goals and objectives, he said.

Hinners said laying out an independent science strategy is important.

"We've tried to tie it up with benefiting education, benefiting competitiveness economically and politically, space commercialization and all those other things," Hinners said. "We're doing ourselves a disservice because I do think there is only one reason. That indeed is the expansion of humans into the solar system. Some people don't believe that is an adequate reason, but I do.

"When I look as a geologist at the evolution of life, I think then from both

the past to the future and of evolution and the spreading of life into the new niches. I find it fascinating and intriguing. Now we have brought ourselves as a civilization—at least part of us—to the point where we are directing our evolution; we are searching the niches and changing the niche to suit us. That I think is incredible and fantastic."

Fisk said there are specific ingredients necessary for a successful exploration program.

"What we need, in simple terms, is an incremental program of high science value which is perceived to be clever in its approach, which adjusts to various funding levels and is part of an overall exploration strategy," he said.

"Such a program in my judgment with patience and perseverance can be initiated and can be sustained and

can grow into a program that will fulfill the human destiny and expand our presence into the solar system."

The next step in the unmanned exploration of Mars will be the Mars Observer, scheduled for launch in September 1992, Stone said. He added that he would like to see more smaller, less costly activities take place on the surface of the red planet.

The next decade will be exciting for the current and planned planetary science programs, he said.

"But I think we have a challenge as a community though, to really take up Len's (Fisk) challenge—to find some clever new ways of advancing our science," Stone said. "Ways which in fact can be done within a somewhat more limited cost than perhaps in the past we've been thinking of, but ways which will give us a new look at nature."

Space News Roundup

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